MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

DIM5058 – MATHEMATICAL TECHNIQUES 1

(*For DIT students only*)

21 OCTOBER 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **2** pages with **4** questions. Key formulae are given in the Appendix.

2. Answer **ALL** questions.

3. Write your answers in the answer booklet provided.

4. All necessary working steps must be shown.

Question 1

a. Solve for x if $\frac{3}{(x-2)} = \frac{3x}{2(x-2)}$. (3 marks)

b. CDP planned to raise a charity sales. They wanted to sell a t-shirt at a price of RM $(p+4)$. They managed to sell $(2p+7)$ of them and collected RM1500 from the sales of the t-shirt.

i. Form an equation in p. Hence, show that the equation reduced to $2p^2+15p-1472=0$. (2 marks)

ii. Solve for p values. Round your answer to the nearest integer. (4 marks)

iii. From answer in part (ii), calculate the quantity of t-shirt sold. (2 marks)

c. Given $2x^2 + x \geq 15$.

i. Solve the inequality. (4 marks)

ii. Test the interval and show your answer on a real number line. (4 marks)

iii. Express the solution set in interval notation. (1 mark)

[TOTAL 20 MARKS]

Question 2

a. Given $\tan\theta = \frac{3}{5}$ and $\sin\theta > 0$, find $\sec\theta$. (4 marks)

b. If $\sin\theta = \frac{2}{5}$, find $\cos\theta$ using the Pythagorean Identity. Assume θ is an acute angle. (6 marks)

c. Let $P(-1,-6)$ be a point on the terminal side of θ. Compute trigonometric functions of

i. $\cos\theta$. (4 marks)

ii. $\cot\theta$. (3 marks)

d. A round tin can is cut into a small wedge with the arc length of x and a central angle of $36°$. Compute the arc length, x if the tin can has a diameter of 9 inches. (5 marks)

e. A supermarket need to build a trolley ramp. If the vertical distance (height) from the sidewalk to the front door is 60 cm and the length of the ramp is 150cm, suggest the suitable angle of elevation for the ramp. (3 marks)

f. Given the function $2y = 8\cos\left(\frac{\pi}{3}(x-4.5)\right)$, find the

i. amplitude. (2 marks)

ii. period. (1 mark)

iii. phase shift. (2 marks)

[TOTAL 30 MARKS]

Continued...

Question 3

a. Find matrix P if $\begin{bmatrix} 3 & 1 \\ -2 & 4 \end{bmatrix}^T + 4P = 2\begin{bmatrix} 7 & 3 \\ 1 & -1 \end{bmatrix}$. (4 marks)

b. Given $A = \begin{bmatrix} 1 & 2 & 3 \\ -2 & 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 2 \\ 0 & 0 \\ -3 & -7 \end{bmatrix}$. Find matrix AB. (4 marks)

c. Lucy manage an ice cream factory that makes three flavors; Vanilla, Chocolate, and Strawberry. The following table summarize the amount of ingredient she adds to each flavor and the total number of stock available in her factory.

Ingredient	Flavor			Total Stock of Ingredients
	Vanilla	Chocolate	Strawberry	
Egg	2	1	1	257
Milk	1	1	2	259
Cream	2	2	1	332

[*Hint: Let x, y, and z be the vanilla, chocolate and strawberry flavor respectively.*]

i. Represent the above information in the form of $AX = B$. (2 marks)

ii. From part (i), solve the value of x, y and z by using the *Cramer's Rule*. (15 marks)

[TOTAL 25 MARKS]

Question 4

a. Write the first five terms of the sequence whose general form is $a_n = \frac{4a_{n-1} + 3}{n}$ and the first term is $a_1 = 3$. (4 marks)

b. The 5th term of an arithmetic sequence is 57 and the 15th term is 187. Find the

i. common difference, d and first term, a_1. (6 marks)

ii. 100th term. (2 marks)

c. Mr. Kim has been saving money in a bank on monthly basis. The first saving is RM15. Every saving of a month is twice of the previous month.

i. Calculate his savings in the first 8 month. (2 marks)

ii. Compute the total saving that he has in one year. (2 marks)

d. Find the sum to infinity for the series $7 + \frac{14}{3} + \frac{28}{9} + \frac{56}{27} + \ldots$ (3 marks)

e. Write the first five terms for the binomial expansion $(x^3 + 3x)^8$. (6 marks)

[TOTAL 25 MARKS]

End of Page.

Appendix:

Inequalities:

$|u| < a \quad \Rightarrow \quad -a < u < a$

$|u| \leq a \quad \Rightarrow \quad -a \leq u \leq a$

$|u| > a \quad \Rightarrow \quad u < -a \quad or \quad u > a$

$|u| \geq a \quad \Rightarrow \quad u \leq -a \quad or \quad u \geq a$

Completing the square

$$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$$

Quadratic formula

If $ax^2 + bx + c = 0$ where $a \neq 0$, then

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Standard form of a quadratic function

$f(x) = a(x - h)^2 + k, \; a \neq 0$

Trigonometric functions

$y = A \sin(Bx - C)$ or $y = A \cos(Bx - C)$

amplitude $= |A|$, period $= \frac{2\pi}{B}$, and phase shift $= \frac{C}{B}$.

Inverse of a 2 × 2 matrix

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $A^{-1} = \frac{1}{ad - bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$, where $ad - bc \neq 0$.

Determinant of a 3 × 3 matrix

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = a_1 \begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix} - b_1 \begin{vmatrix} a_2 & c_2 \\ a_3 & c_3 \end{vmatrix} + c_1 \begin{vmatrix} a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

Cramer's Rule for 3 × 3 matrix

$a_1x + b_1y + c_1z = d_1$
$a_2x + b_2y + c_2z = d_2$
$a_3x + b_3y + c_3z = d_3$

then $x = \frac{D_x}{D}, y = \frac{D_y}{D}, z = \frac{D_z}{D}$ where

$$D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \; D_x = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \; D_y = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \; D_z = \begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}$$

Arithmetic sequence

$$a_n = a_1 + (n-1)d$$
$$S_n = \frac{n}{2}(a_1 + a_n)$$

Geometric sequence

$$a_n = a_1 r^{n-1}, \; S_n = \frac{a_1(1-r^n)}{1-r}$$
$$S_\infty = \frac{a_1}{1-r}, |r| < 1$$

Binomial Theorem

$$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k; \quad n \geq 1$$

The $(r + 1)^{st}$ term in the expansion of $(a + b)^n$ is $\binom{n}{r} a^{n-r} b^r$.